

EXHIBIT 3

**UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION**

In Re Flint Water Cases

Case No. 16-cv-10444
Hon Judith E. Levy
United States District Judge

DECLARATION OF DAVID MADIGAN, Ph.D.

I, David Madigan, Ph.D., declare on oath and state as follows:

1. My name is David Madigan, Ph.D.
2. I am of sound mind, over the age of 18, legally competent, capable in all respects of making this declaration, and personally acquainted with the facts stated herein. All the facts contained herein are true, correct, and based on my personal knowledge.
3. I am Provost and Senior Vice President for Academic Affairs at Northeastern University in Boston, where I am also a Professor of Statistics in the Khoury College of Computer Sciences. I am Professor Emeritus of Statistics at Columbia University in New York City. I am also an epidemiologist and an expert in epidemiology. From 2013 to 2018, I was also the Executive Vice-President of Arts and Sciences and Dean of the Faculty. I was chair of the Columbia Department of Statistics from 2008 to 2013.

4. I received my bachelor's degree in mathematical sciences from Trinity College Dublin in 1984 and was awarded the College's gold medal. In 1990, I received a Ph.D. in Statistics, also from Trinity College. I have worked in the past for KPMG, SkillSoft, University of Washington, AT&T Labs, and Soliloquy Inc. From 2005 to 2007, I was Professor of Statistics and Dean of Physical and Mathematical Sciences at Rutgers University. Prior to serving as Dean, I was Director of the Rutgers University Institute of Biostatistics. I am an elected Fellow of both the Institute of Mathematical Statistics and the American Statistical Association, as well as the American Association for the Advancement of Science, and was the 36th most cited mathematician worldwide from 1995-2005. I was an Institute of Mathematical Statistics Medallion Lecturer in 2009. I served a term as the Editor of Statistical Science from 2008 to 2010, the highest-impact journal in Statistics.

5. I have published more than 200 technical papers on Bayesian statistics, biostatistics, pharmacovigilance, statistical graphics, Monte Carlo methods, computer-assisted learning, information retrieval, and text mining. Within the last few years, I have consulted for Boehringer-Ingelheim, Clarus Therapeutics, CSL Behring, Jarvik Heart, Lilly, Novartis, Pfizer, Sanofi-Aventis, Takeda, and Wyeth on a variety of issues, many related to drug safety.

6. I have considerable statistical experience with clinical trials, including the design and analysis of pain studies at the University of Washington and the Fred Hutchinson Cancer Research Center, both in Seattle, and serve as a statistical consultant to multiple internal and external clients, particularly while I was director of the Institute of Biostatistics at Rutgers University.

7. Drug safety is one of my significant research interests, with a focus on the development and application of statistical methods for pharmacovigilance. I have published my work in *Drug Safety*, *Pharmacoepidemiology and Drug Safety*, *Therapeutic Advances in Drug Safety*, *Epidemiology*, *the American Journal of Epidemiology*, and other journals. I have also served as an investigator in the Mini-Sentinel project. Mini-Sentinel is a pilot project sponsored by the FDA to inform and facilitate the development of a fully operational active surveillance system, the Sentinel System, for monitoring the safety of FDA-regulated medical products. In 2010-11, I led the Mini-Sentinel Working Group on case-based methods in active surveillance. In addition, from 2010 to 2013, I was a Principal Investigator for the Observational Medical Outcomes Partnership (OMOP), a public-private partnership between the FDA and the pharmaceutical industry. The partnership conducted a multi-year initiative to research methods that are feasible and useful in analyzing existing healthcare databases to identify and evaluate safety and benefit issues of drugs already on the market. The OMOP work now continues in the Observational

Health Data Sciences and Informatics (OHDSI) collaborative, where I formerly co-directed the Columbia-based coordinating center. I was a member of the FDA's Drug Safety and Risk Management Advisory Committee from 2011 to 2014.

8. My curriculum vitae, a copy of which is attached as Exhibit 1, provides further information concerning my background, training, and experience, including a complete list of publications. A list of the materials I reviewed in this case is attached as Exhibit 2. The R code to produce the analyses in this report is attached as Exhibit 3.

9. In 2019, Roy & Edwards published an article advancing what they termed to be a "novel hypothesis" that lead in biosolids could be used as a valid and accurate surrogate for lead in water in the absence of reliable testing of water for lead.¹

10. They used water lead level ("WLL") testing by Virginia Tech ("VATECH"), as reflected in a 2018 publication by Pieper et al.,² against data provided by the MDEQ regarding lead in biosolids in the Flint Wastewater Treatment Plant ("FWWTP") for the same period.

¹ Roy et al., "Lead release to potable water during the Flint, Michigan water crisis as revealed by routine biosolids monitoring data", *Water Research*, Vol. 160, Sept. 1, 2019, 475-483. doi.org/10.1016/j.watres.2019.05.091.

² Roy and Edwards, "Efficacy of corrosion control and pipe replacement in reducing citywide lead exposure during the Flint, MI water system recovery", *Environ. Sci.: Water Res. Technol.*, 2020, 6, 3024-3031. doi.org/10.1039/D0EW00583E.

11. I have reviewed both the biosolids data provided to Roy & Edwards by the MDEQ as well as the VATECH water sampling data published by Pieper.

12. Figure 2 in the 2019 Roy & Edwards article (p. 478) shows the purported correlation between lead in the water and lead in the biosolids, which the authors claim supports their “novel hypothesis”. The R^2 was 0.86 with a corresponding p-value of 0.023 (i.e., statistically significant).

13. To achieve the correlation shown in Figure 2 of their article, however, the authors employed certain methods. Specifically, they made two centrally important choices regarding the data they used – the absence of either of which nullifies the claimed correlation.

14. First, they employed what they claimed was a “one month offset between WLL90 data from Virginia Tech’s citywide sampling campaigns with metals in biosolid data,…” (p. 477).

15. Second, unlike the concentration of lead in water (from the Pieper data), Roy & Edwards used the mass of lead in biosolids (which they estimated), and not the concentration of lead in biosolids – which was the data provided to them by the MDEQ and would have allowed for an apples-to-apples comparison to the concentration of lead in water.

16. The choice of each of the above is curious/problematic for the reasons set forth below, but the choice of both was necessary to achieve the correlation that supported their novel hypothesis and to achieve statistical significance.

17. First, regarding the choice of the one month offset, Roy & Edwards claim that this was done to reflect the estimated lag time for the lead coming out of the tap to reach and be measurable in the sludge at the FWWTP.

18. Specifically, they state that: “[a] one month offset was used between WLL90 data from Virginia Tech’s citywide sampling campaigns with metals in biosolid data, to partly account for the two weeks... of biosolids retention time... in the plant digester and another few days of activated sludge detention time. ***For example, water samples collected from homes throughout the month of August 2015 were paired with total lead mass in biosolids early September.***” (p. 477) (*emphasis added*).

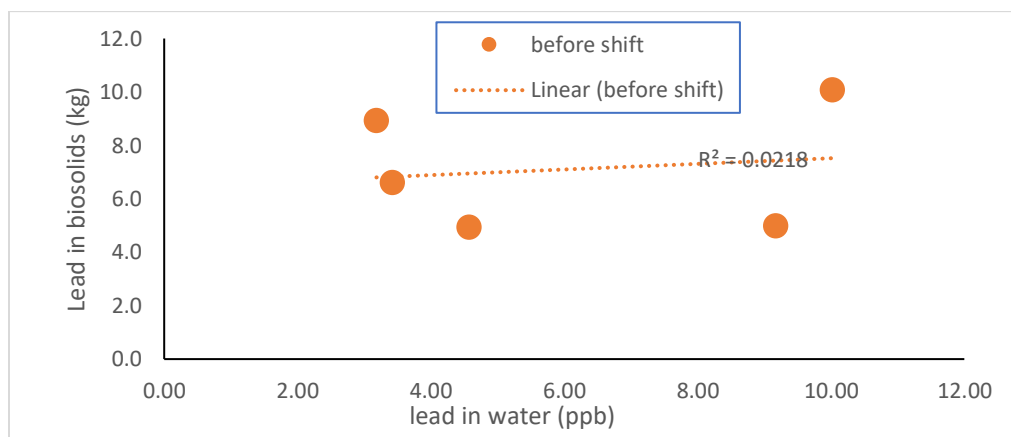
19. However, as acknowledged on the VATECH water sampling team’s website³, the sampling campaigns may have **started** in a certain month, but they extended well into the following month. For example, the August 2015 sampling campaign **started** on August 20, 2015, but it lasted until September 10, 2015. As

³ Comment by Siddhartha Roy, *[Complete Dataset] Lead results from Tap Water Sampling in Flint, MI, FLINTWATERSTUDY* (Feb. 1, 2016, 6:50 PM), <https://flintwaterstudy.org/2015/12/complete-dataset-lead-results-in-tap-water-for-271-flint-samples/>.

such, contrary to the assertion stated, there was not a one month offset between the August 2015 sampling campaign and the “early September” biosolids data point used.

20. Removing this choice by Roy & Edwards and measuring the August/March/July/November/August biosolid data against the August/March/July/November/August water sampling data results in a non-significant R^2 of 0.027, $p=0.79$,⁴ and yields no statistically reliable support for their “novel hypothesis.” Figure 1 below shows this:

⁴ This was not unknown to the authors, as (in VATECH_00139353 – Sheet3) they actually plotted the correlation (or more precisely the lack thereof) using the biosolid data **without** the one month offset and came up with an $R^2 = 0.0218$ and the following graph:



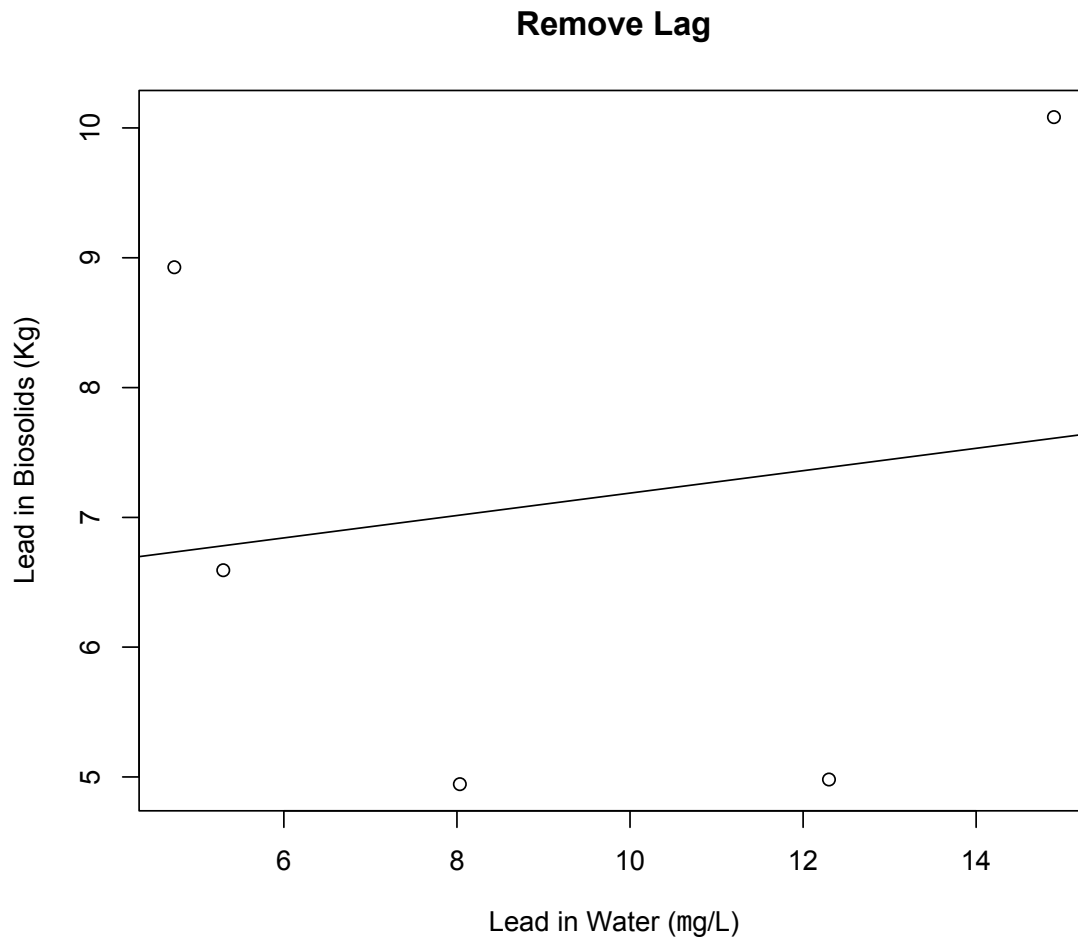


Figure 1. Lead mass in biosolids versus lead concentration in water (WLL90), no time lag.

21. Furthermore, the choice NOT to compare concentrations of lead in biosolids (which is the data provided to Roy & Edwards by the MDEQ) against concentrations of lead in water (which is the data they had from Pieper), but to instead use (an estimation of) lead mass is perhaps the most curious choice made. Significantly, this choice is completely unexplained in the article itself. Second, to the extent the authors were concerned with the possibility that other metals might

have been present in the biosolids in differing concentrations, in different months, the authors claim to have demonstrated a strong correlation among and between the plumbing-related metals therein. (p. 481)⁵

22. Had the authors used the concentration of lead in the biosolids – i.e., the data provided to them by the MDEQ and an apples-to-apples for comparison with the concentration of lead in the water (from the Pieper 2018 data), the correlation would have been $R^2 = 0.56$ and not statistically significant ($p=0.14$). While one might think that such a correlation was moderate, the truth (as demonstrated by Figure 2 below) is that such a conclusion would be deceptive.

⁵ Moreover, the authors claim that “[i]n Flint, less than 5% of wastewater is derived from industry, which has largely eliminated its lead sources..., further increasing the likelihood that the lead captured in Flint biosolids is mostly derived from domestic plumbing release to potable water.” (p. 476). This would negate the need to worry about dilution from non-plumbing related sources.

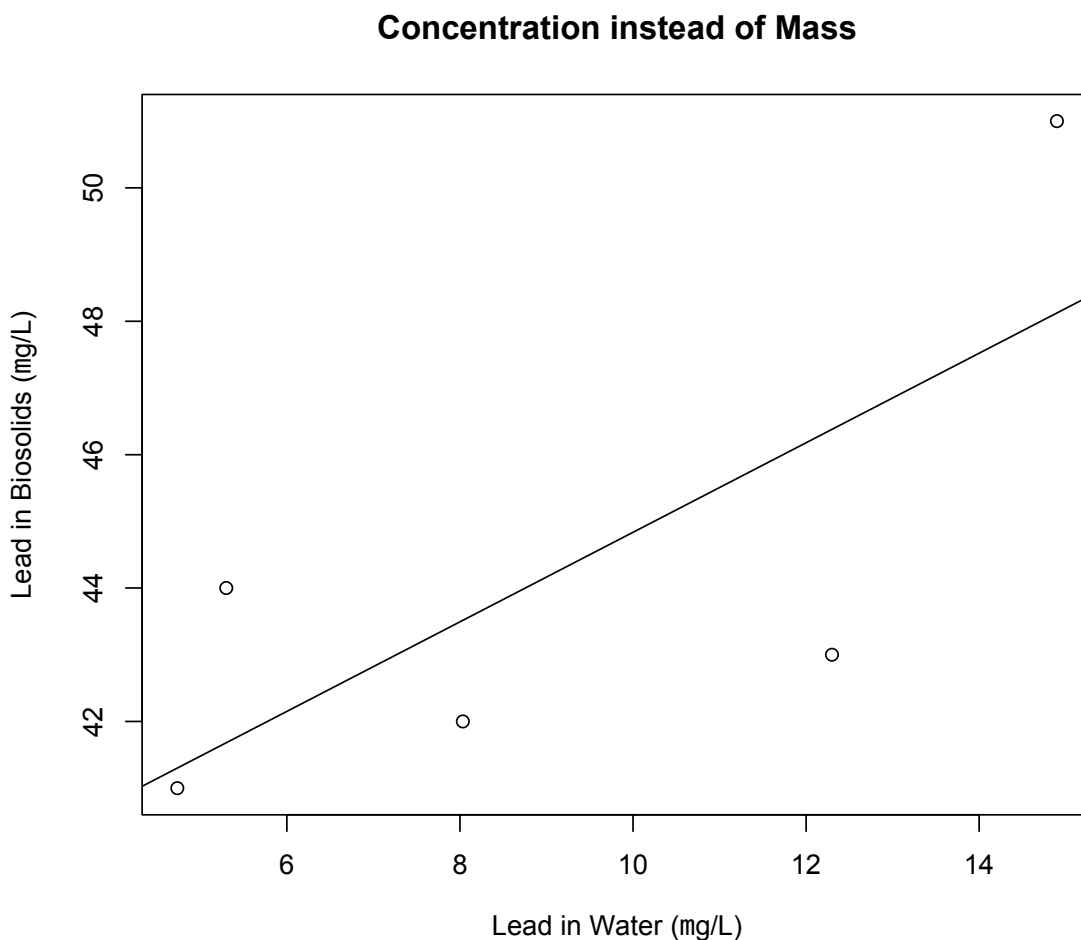


Figure 2. Lead concentration in biosolids versus lead concentration in water (WLL90), one-month time lag.

23. As shown above, except for a single datapoint on the upper right, there is actually no correlation between the concentration of lead in Flint's water and the concentration of lead in its biosolids; and it is the one outlier datapoint that skews the R^2 and could mislead. Regardless, the correlation is not statistically significant.

24. Had the authors both used the concentration of lead in the biosolids and not introduced a one-month lag into the analysis, the correlation between the biosolid

measurements and the water measurements would have actually been negative (and not statistically significant) – see Figure 3 below.

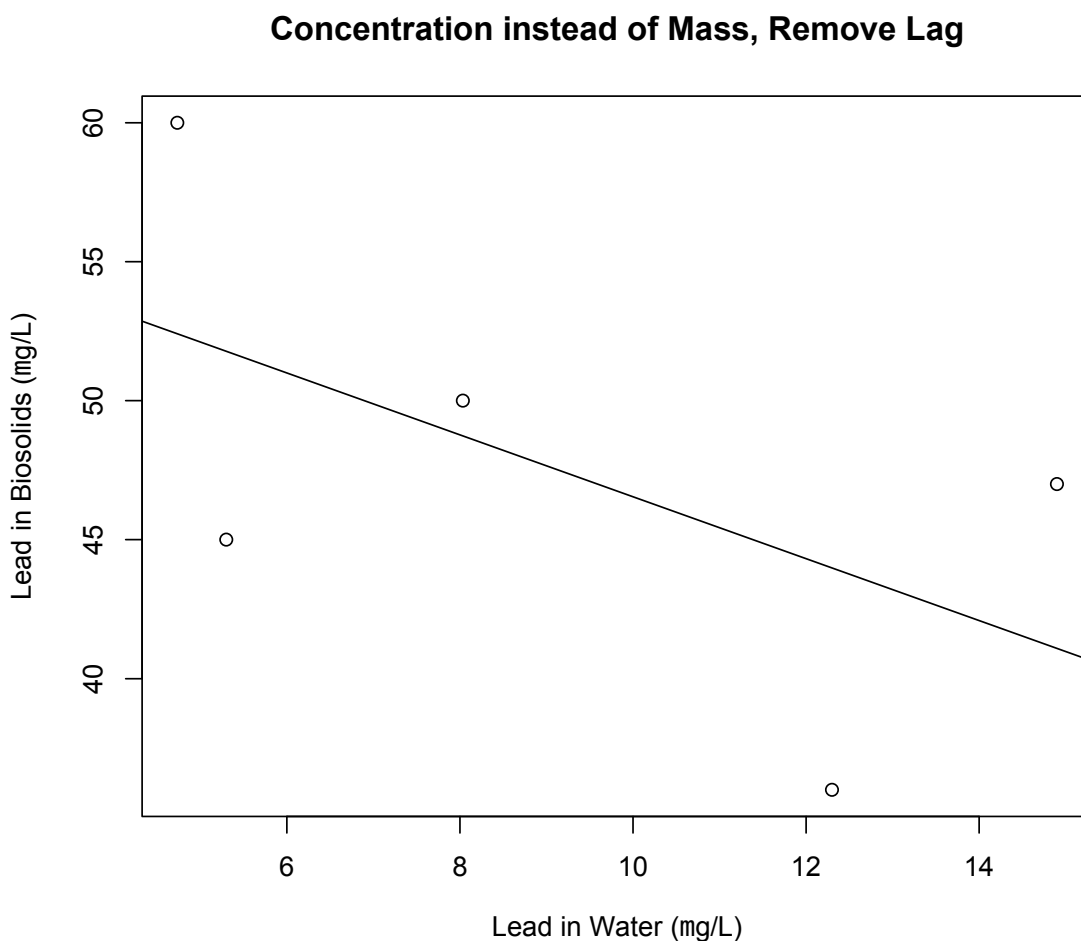


Figure 3. Lead concentration in biosolids versus lead concentration in water (WLL90), no time lag

25. Given the delay in the WLL measurements mentioned in paragraph 19 above, one could argue for a *two-month* lagged analysis. Figure 4 below plots the lead in biosolids (both mass and concentration) against the water lead levels with a

two-month lag. The correlation with biosolids mass is actually negative. Neither correlation is statistically significant.

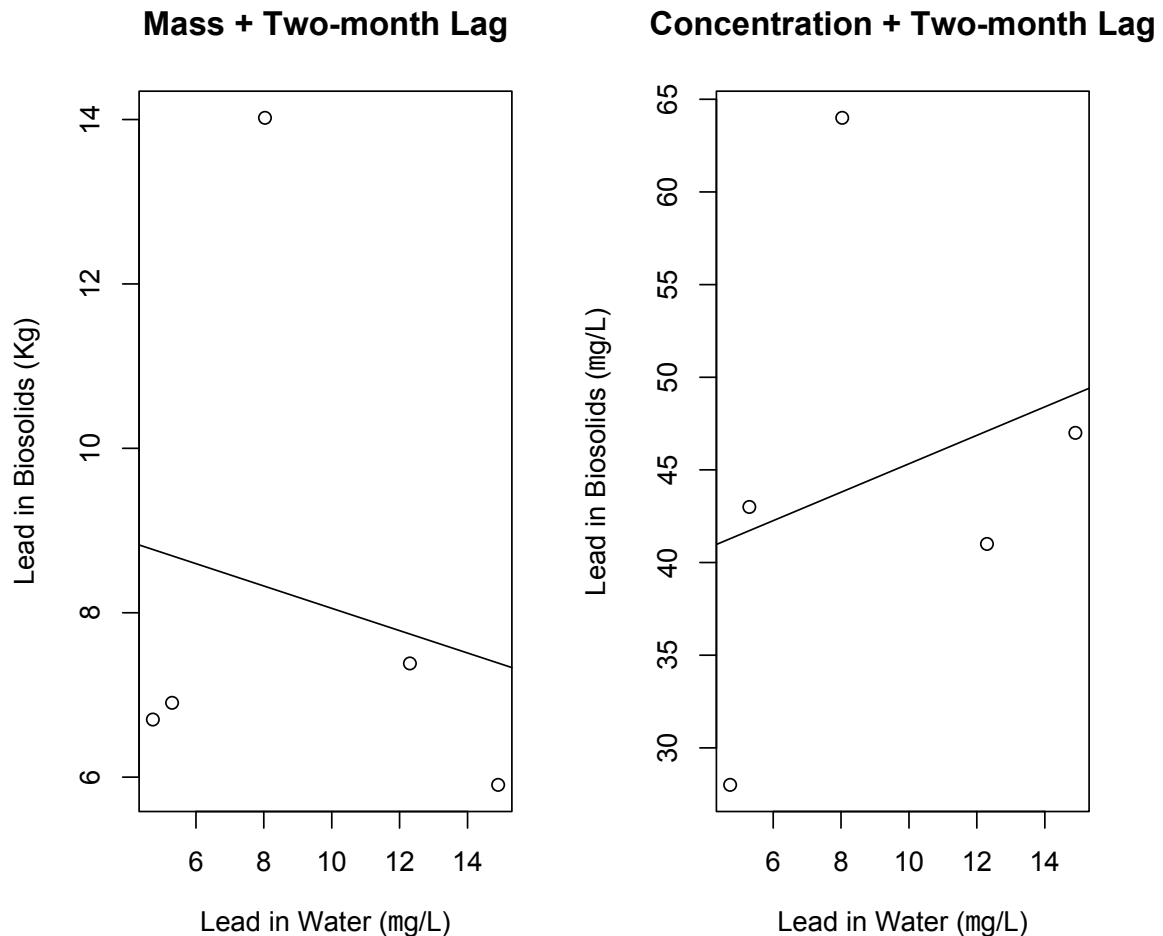


Figure 4. Lead mass in biosolids (left hand panel) and lead concentration in biosolids (right hand panel) versus lead concentration in water (WLL90), two-month time lag

26. In sum, changing **either** of Roy & Edwards's two choices alone nullifies the claimed correlation that supports their “novel hypothesis”. As demonstrated by Figure 3 below, if **both choices** had been different, the correlation would actually

have been negative. Their own rationale for the choice of a one-month lagged analysis would actually argue for a two-month lagged analysis; such an analysis shows no significant correlation between biosolid lead levels and water lead levels.

27. I note that, for the water levels Roy & Edwards used an arbitrary weighted average of 1/3 First Draw, 1/3 Second Draw, and 1/3 Third Draw for the WLL90 data points in Figure 2. In order to provide a valid comparison with the total mass of lead in the biosolids, it would have to be shown that each of the three draws contributed equally and representatively to the total amount of water carrying lead to the FWWTP.

28. Moreover, Roy & Edwards state that “the first draw water is often derived from pure copper pipe, whereas the second draw sample is often from a service line with pure lead or galvanized iron pipe (i.e., the first draw has highest copper and relatively low lead, the *second draw has highest lead* and almost no copper).” (p. 477 – *emphasis added*) Yet the data they rely upon from Pieper 2018 (Table 2) shows exactly the opposite. For each of the five sampling campaigns, the *First Draw had the highest* lead levels (26.8, 24.5, 15.1, 9.2, and 9.0); the *Second Draw was significantly lower* (11.3, 9.0, 5.7, 3.0, and 3.0), and the Third Draw was even lower (6.6, 3.4, 3.3, 2.8, and 2.2).

29. The essence of Roy and Edwards' novel hypothesis is that lead in biosolids could be used as a valid and accurate surrogate for lead in water in the absence of reliable testing of water for lead. For this hypothesis to be valid, when reliable water testing shows increasing lead levels, the levels of lead in biosolids should likewise increase. Conversely, when reliable water testing shows decreasing lead levels, the levels of lead in biosolids should likewise decrease.

30. Yet, as shown in Figure 5 below, while the level of lead in water—as revealed by testing by VATECH after August 2015—dramatically decreased, the level of lead in biosolids (whether by mass or by concentration) over the same period generally trended in the opposite direction.

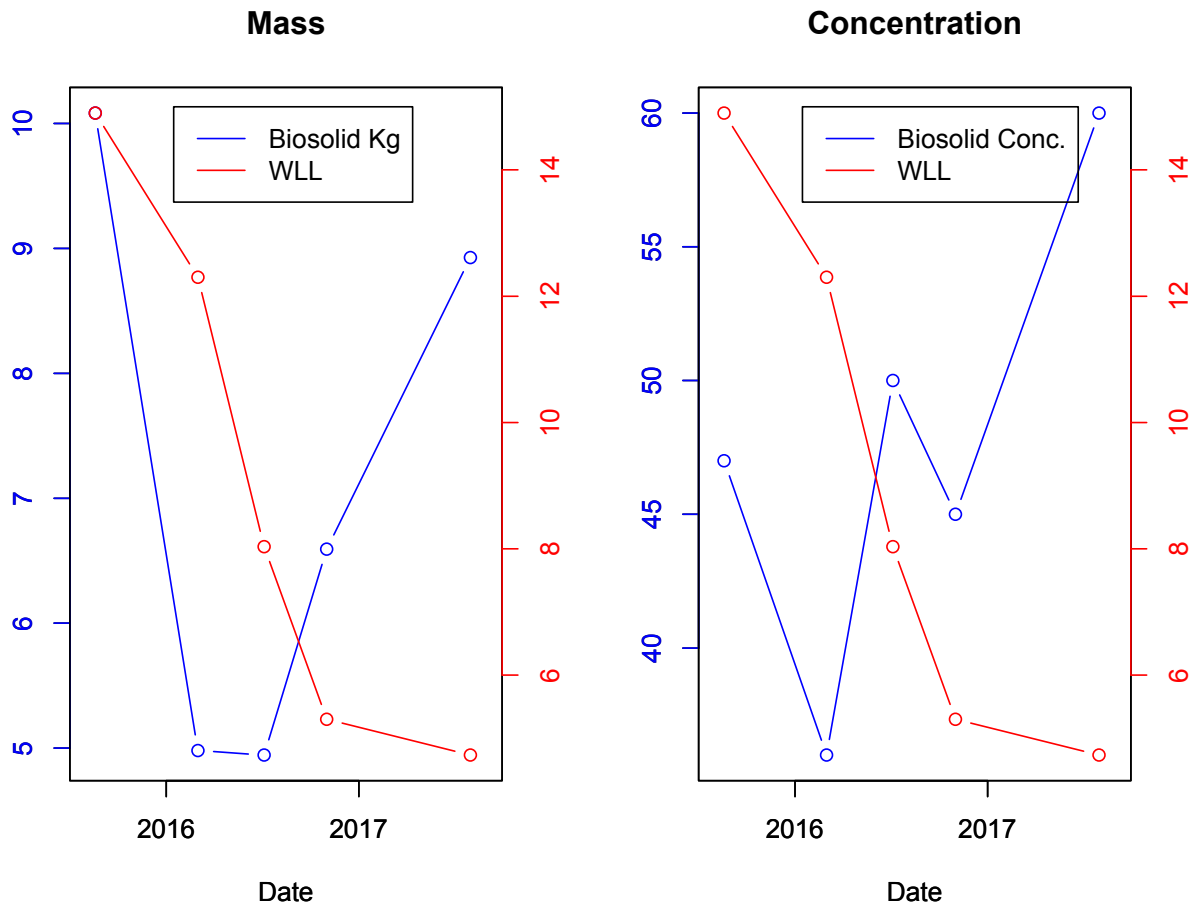


Figure 5. Lead mass in biosolids (left hand panel) and lead concentration in biosolids (right hand panel) and lead concentration in water (average of FD, 1, and 3, per the authors), versus time.

31. In fact, while the water lead levels **decreased monotonically** over the period of the measurements, lead in biosolids actually **increased** (by both mass and concentration) twice. This unexplained divergence argues against the novel hypothesis advanced by Roy & Edwards.

32. Accordingly, the validity and necessity of the choices made, the principles applied and the methods used to achieve statistically significant

correlation must be adequately demonstrated, and the questions and difficulties posed above must be answered and explained before the novel hypothesis advanced by this interesting article can be said to have been reliably proven.

I declare under penalty of law that the following is true and correct.

Executed on April 15, 2024
Brookline, Massachusetts

A handwritten signature in blue ink, appearing to read "David Madigan". The signature is fluid and cursive, with the first name "David" being more prominent than the last name "Madigan".

/s/ DAVID MADIGAN
David Madigan, Ph.D.

EXHIBIT 1

David Madigan

davidbennettmadigan@gmail.com

Tel: (862) 812-3690

Curriculum Vitae

1 November 2023

Education

Trinity College Dublin, Ph.D., Statistics, 1990. Dissertation “An investigation of weights of evidence in the context of probabilistic expert systems.” K. R. Mosurski, Advisor.

Trinity College Dublin, B.A. (Mod.), Mathematics, 1984, First Class Honours.

Employment History

2020 - : Northeastern University

2020 - : Provost & Senior Vice-President for Academic Affairs

2020 - : Professor of Statistics

2007 - 2020 : Columbia University

2007 - 2020 : Professor of Statistics

2013 - 2018 : Executive Vice-President for Arts and Sciences

2013 - 2018 : Dean of the Faculty of Arts and Sciences

2007 - 2013 : Chair, Department of Statistics

2001 - 2007 : Rutgers University

2001 - 2007 : Professor of Statistics and Biostatistics

2005 - 2007 : Dean, Physical and Mathematical Sciences

2003 - 2004 : Director, Institute of Biostatistics

2000 - 2001 : Vice President, Data Mining, Soliloquy, Inc.

1999 - 2000 : Principal Technical Staff Member, AT&T Labs-Research

1990 - 1999 : University of Washington/ Fred Hutchinson Cancer Research Center

1995 - 1999 : Associate Professor of Statistics, UW

1992 - 1999 : Assistant/Associate Member, FHCRC

1990 - 1995 : Assistant Professor of Statistics, UW

1989 - 1990 : Information Technology Consultant, KPMG, Ireland

1986 - 1989 : Technology Manager, Peregrine Expert Systems Ltd., Ireland

1985 - 1986 : Expert System Consultant, SkillSoft, Ireland

1984 - 1985 : Actuarial Associate, Hibernian Life Assurance, Ireland

Honors

- 2014: Elected Member of the International Statistical Institute
- 2012: Elected Fellow of the American Association for the Advancement of Science.
- 2009: Institute of Mathematical Statistics Medallion Lecturer.
- 2006: Elected Fellow of the Institute of Mathematical Statistics.
- 2005: 36th Most Cited Mathematician in the World, 1995-2005, ISI Thomson.
- 1999: Elected Fellow of the American Statistical Association.
- 1995: University of Washington Distinguished Teaching Award.
- 1984: Gold medal awarded by the board of Trinity College Dublin.
- 1980: Trinity College Dublin, Entrance Scholarship in Mathematics.

Refereed Publications

1. Selzman, C.H., Feller, E.D., Walker, J.C., Sheridan, B.C., Silvestry, S.C., Daly, R.C., Anyanwu, A.C., Madigan, D., Liu, P-Y., Frazier, O.H., and Griffith, B.P. (2022). The Jarvik 2000 Left Ventricular Assist Device: Results of the United States Bridge to Transplant Trial. *ASAIO Journal*, to appear.
2. Schuemie, M.J., Chen, Y., Madigan, D., and Suchard M. (2021). Combining Cox Regressions Across a Heterogeneous Distributed Research Network Facing Small and Zero Counts. *Statistical Methods in Medical Research*, <https://doi.org/10.1177/09622802211060518>.
3. Zagar, A., Kadziola, Z., Lipkovich, I., Madigan, D., and Faries, D. (2021). Evaluating Bias Control Strategies in Observational Studies Using Frequentist Model Averaging. *Journal of Biopharmaceutical Statistics*, DOI: [10.1080/10543406.2021.1998095](https://doi.org/10.1080/10543406.2021.1998095).
4. Chen, R., Suchard, M.A., Krumholz, H.M., Schuemie, M.J., Shea, S., Duke, J., Pratt, N., Reich, C.G., Madigan, D., You, S.C., Ryan, P.B., and Hripcsak, G., (2021). Comparative first-line effectiveness and safety of angiotensin converting enzyme inhibitors and angiotensin receptor blockers: a multinational cohort study. *Hypertension*, <https://doi.org/10.1161/HYPERTENSIONAHA.120.16667>.
5. Hripcsak, G., Schuemie, M.J., Madigan, D., Ryan, P.B., and Suchard, M. (2021). Drawing reproducible conclusions from observational clinical data with OHDSI. *Yearbook of Medical Informatics*, DOI: 10.1055/s-0041-1726481.
6. Park, S., You, S.C., Krumholz, H.M., Suchard, M.A., Schuemie, M., Hripcsak, G., Chen, R., Shea, S., Duke, J., Pratt, N., Reich, C., Madigan, D., Ryan, P., and Park, R.W. (2021). Comprehensive comparative effectiveness and safety of first-line beta-blocker monotherapy in hypertensive patients: a large-scale multi-center observational study. *Hypertension*, to appear.
7. Dwivedi, R., Tan, Y. S., Park, B., Wei, M., Horgan, K., Madigan, D., & Yu, B. (2020). Stable discovery of interpretable subgroups via calibration in causal studies. *International Statistical Review*, 88, S1, S135-S178 doi:10.1111/insr.12427.

8. You, S.C., Rho, Y., Bikdeli, B., Kim, J., Siapos, A., Weaver, J., Londhe, A., Cho, J., Park, J., Schuemie, M., Suchard, M.A., Madigan, D., Hripcsak, G., Gupta, A., Reich, C. G., Ryan, P.B., Park, R.W., and Krumholz, H.M. (2020). Association of ticagrelor versus clopidogrel with net adverse clinical events in patients with acute coronary syndrome undergoing percutaneous coronary intervention. *JAMA*. 2020;324(16):1640-1650. doi:10.1001/jama.2020.16167.
9. Kim, Y., Tian, Y., Yang, J., Huser, V., Jin, P., Lambert, C., Park, H., You, S.C., Park, R.W., Rijnbeek, P., Zandt, M., Reich, C., Vashisht, R., Wu, Y., Duke, J., Hripcsak, G., Madigan, D., Shah, N., Ryan, P., Schuemie, M., Suchard, M. (2020). Comparative safety and effectiveness of alendronate versus raloxifene in women with osteoporosis. *Scientific Reports*, 10.1 (2020): 1-10.
10. Schuemie, M.J., Ryan, P.B., Pratt, N., You, S.C., Krumholz, H.M., Madigan, D., Hripcsak, G. and Suchard, M.A. (2020). Principles of Large-Scale Evidence Generation and Evaluation across a Network of Databases (LEGEND). *Journal of the American Medical Informatics Association*, <https://doi.org/10.1093/jamia/ocaa103>
11. Schuemie, M.J., Ryan, P.B., Pratt, N., You, S.C., Krumholz, H.M., Madigan, D., Hripcsak, G. and Suchard, M.A. (2020). Large-Scale Evidence Generation and Evaluation across a Network of Databases (LEGEND): Assessing Validity Using Hypertension as a Case Study. *Journal of the American Medical Informatics Association*, <https://doi.org/10.1093/jamia/ocaa124>.
12. Schuemie, M.J., Cepeda, M.S., Suchard, M.A., Yang, J., Tian, Y., Schuler, A., Ryan, P.B., Madigan, D., and Hripcsak, G. (2020). How Confident Are We About Observational Findings in Healthcare: A Benchmark Study. *Harvard Data Science Review*, 2.1, DOI: 10.1162/99608f92.147cc28e.
13. Hripcsak, G., Suchard, M.A., Shea, S., Chen, R., Pratt, N., Madigan, D., Krumholz, H.M., Ryan, P.B., and Schuemie, M.J. (2019). Real-World Evidence on the Effectiveness and Safety of Chlorthalidone and Hydrochlorothiazide. *JAMA Internal Medicine*, doi:10.1001/jamainternmed.2019.7454.
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16. Schuemie, M., Ryan, P., Hripcsak, G., Madigan, D., and Suchard, M. (2018). Improving reproducibility by using high-throughput observational studies with empirical calibration. *Philosophical Transactions A*, **376**:20170356. <http://dx.doi.org/10.1098/rsta.2017.0356>.
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19. Berger, M., Sox, H., Willke, R., Brixner, D., Eichler, H-G., Madigan, D., Makady, A., Schneeweiss, S., Tarricone, R., Wang, S., Mullins, D., Watkins, J. (2017). Recommendations for Good Procedural Practices for Real-World Data Studies of Treatment Effectiveness and/or Comparative Effectiveness: Report of the Joint ISPOR-ISPE Special Task Force on Real-World Evidence in Health Care Decision Making. *Pharmacoeconomics and Drug Safety*, DOI: 10.1002/pds.4297.
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27. Moghaddass, R., Rudin, C., and Madigan, D. (2016). The Factorized Self-Controlled Case Series Method: An Approach for Estimating the Effects of Many Drugs on Many Outcomes. *Journal of Machine Learning Research*, 17(185):1–24, 2016.
28. Beck, H.E., Mittal, S., Madigan, D., and Burd, R.S. (2015). Reassessing mechanism as a predictor of pediatric injury mortality. *Journal of Surgical Research* 199 (2), 641-646.
29. Boland, M.R., Z Shahn, D Madigan, G Hripcsak, NP Tatonetti (2015). Birth Month Affects Lifetime Disease Risk: A Phenome-Wide Method. *Journal of the American Medical Informatics Association*, DOI: <http://dx.doi.org/10.1093/jamia/ocv046>.
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32. Hripcsak, G., Jon D Duke, Nigam H Shah, Christian G Reich, Vojtech Huser, Martijn J Schuemie, Marc A Suchard, Rae Woong Park, Ian Chi Kei Wong, Peter R Rijnbeek, Johan van der Lei, Nicole Pratt, G Niklas Norén, Yu-Chuan Li, Paul E Stang, David Madigan, and Patrick B Ryan (2015). Observational Health Data Sciences and Informatics (OHDSI): Opportunities for Observational Researchers. *MedInfo, Stud Health Technol Inform.* 2015; 216: 574–578.
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Letters to the Editor/Commentaries

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200. York, J. and Madigan, D. (1993). Discussion of the paper by Smith and Roberts, *Journal of the Royal Statistical Society (Series B)*, **55**, 88.
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Other Publications

204. Egilman, D., Madigan, D., Yimam, M., and Tran, T. (2020). Evidence that cosmetic talc is a cause of ovarian cancer. *Gynecology and Pelvic Medicine*. doi: 10.21037/gpm-20-28
205. Mulgrave, J.J., Madigan, D., and Hripcsak, G. (2020). Bayesian Posterior Interval Calibration to Improve the Interpretability of Observational Studies. arXiv:2003.06002, 2020
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210. Hauben, M., Madigan, D., Patadia, V., Sakaguchi, M., van Puijenbroek, E. (2010). Quantitative signal detection for vaccines. *Human Vaccines*, 6, 1.
211. Madigan, D. (2007). Introduction to the LARS chapter. Volume celebrating Efron's 60th birthday, Springer.
212. Dayanik, A., Genkin, A., Kantor, P., Lewis, D.D., and Madigan, D. (2005). DIMACS at the TREC 2005 Genomics Track. TREC 2005.
213. Eyheramendy, S., Genkin, A., Ju, W-H., Lewis, D.D., and Madigan, D. (2003). Sparse Bayesian classifiers for text categorization. *JICRD*.
214. Madigan, D. (2003). Sparse Bayesian classifiers for text categorization. *Proceedings of the International Statistical Institute*.
215. Chaudhuri, S., Madigan, D., and Fayyad, U.M. (2000). KDD-99: The Fifth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining. *SIGKDD Explorations*, 1, 49-51.
216. Nakamura, Y., Chabal, C., Chapman, C.R., Dunbar, P.J., Madigan, D., and Minstrell, J. (1997). FABLE: A computer-based tool for teaching geriatric pain management skills. In *Proceedings of the Annual Conference of the American Pain Society*.
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219. Clarkson, D.B., Donnell, D., Minstrell, J., Hunt, E., Madigan, D., and Traynor, C. (1994). Vital: An intelligent tutoring system for statistics. *American Statistical Association, Proceedings of Section on Statistical Education*, 88-93.
220. Dunbar, P.J., Madigan, D., Lam, A.M., and Matta, B.F. (1994). A hypermedia instruction tool for teaching retrograde jugular venous cannulation. Multimedia Scientific Exhibit at the 1994 Meeting of the American Society of Anesthesiologists, San Francisco, CA.
221. Madigan, D. (1989). Microcomputer research at the Meath hospital. *Irish Medical Times*, **21** (34), 14-15.
222. Madigan, D. (1989). Expert systems in government. *Irish Computer*, 22-24.

Book and Software Reviews

223. Madigan, D. (2002). A review of “Principles of Data Mining” by Hand, Mannila, and Smyth. *SLAM Review*, **44**, 501-502.
224. Madigan, D. (2001). A review of “Probabilistic Networks and Expert Systems” by Cowell, Dawid, Lauritzen, and Spiegelhalter. *Journal of the American Statistical Association*, **96**, 1524.
225. Madigan, D. (1994). A review of MIM: graphical modelling software. *Statistics and Computing*, **4**, 33–39.
226. Madigan, D. (1994). A review of “Graphical models in applied multivariate statistics” by Joe Whittaker. *Networks*, **24**, 125.

Unpublished Technical Reports

227. Brookhart, M.A., Ryan, P., Madigan, D., Sturmer, T. (2011). An Empirical Comparison of Different Implementations of a Standardized New User Design For Drug Safety Surveillance.
228. Egilman, D., Madigan, D., and Druar, N.M. (2011). A Drug Trial Gone Wrong: Excess Death and Injury Among Study Volunteers in an Unmonitored Alzheimer's Drug Study.
229. Ryan, P.B., Reich, C., Welebob, E., Overhage, J.M., Stang, P.E., Hartzema, A.G., Racoosin, J.A., Scarnecchia, T., Madigan, D. (2011). Managing data quality for an active surveillance system.
230. Pickering, W.H., Madigan, D., McCarter, R.J., and Burd, R.S. (2009). Evaluating relative importance of injury groupings on in-hospital mortality.
231. Hauben, M., Madigan, D., Reisinger, S., Hochberg, A., and O'Hara, D. (2008). Effects of Stratification on Three Pharmacovigilance Data Mining Algorithms.
232. Ju, Wen-Hua, Madigan, David, and Scott, Steven (2002). On Bayesian learning of sparse classifiers.
233. J.W. O’Kane, G. Ridgeway, and D. Madigan (1999). Statistical Analysis of Clinical Variables to Predict the Outcome of Surgical Intervention in Patients with Knee Complaints.
234. Madigan, D. (1998). Combining probability distributions: A Review. Statistical Sciences Inc. Research Report.
235. Schaffner, A., Madigan, D., Clarkson, D.B., Donnell, D., Hunt, E.B., Keim, M., Minstrell, J., Nason, M., and Volinsky, C.T. (1996). Facet-based learning for statistics.
236. Schaffner, A., Madigan, D., Hunt, E.B., and Minstrell, J. (1996). Virtual benchmark instruction.
237. Madigan, D., Hunt, E., Levidow, B., and Donnell, D. (1995). Bayesian graphical models for intelligent tutoring systems.
238. Madigan, D. (1992). Temporal Reasoning with Probabilities: A Review. Statistical Sciences Inc. Research Report Number 7.
239. Madigan, D. (1992). Approaches to Explanation in Bayesian Networks. Statistical Sciences Inc. Research Report Number 8.
240. Carlsen, J.C., Madigan, D. and Bradshaw, D. (1992). Music expectancy and its measurement. UW Department of Music Technical Report.

Research Grants

Principal Investigator on sub-contract to Northeastern University from FDA Award 75F40120D0039 to Columbia University, 2020-2023, \$601,673.

Principal Investigator on sub-contract from NSF Award IIS 1251151 to UCLA, “Patient-level predictive modeling from massive longitudinal databases.” 2013-2017, \$217,837.

Principal Investigator on FNIH/Observational Medical Outcomes Partnership grant to Columbia University, “Methods for Active Drug Safety Surveillance,” 2009-2013.

Co-Principal Investigator on National Institutes of Health grant “Improving Pediatric Trauma Triage Using High Dimensional Data Analysis,” R01 GM87600-01, 2010-2013.

Principal Investigator on sub-contract from FDA Award HHSF223200910006I to Harvard Pilgrim Healthcare, “Mini-sentinel,” 2010-2011.

Investigator on Department of Homeland Security grant “Center for Dynamic Data Mining” to Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), Rutgers University, 2006-2009, \$2,400,000 total.

Principal Investigator on National Science Foundation grant “Bayesian Methods for Large-Scale Applications” to Columbia University, DMS-0505599, 2005-2009, \$150,000 total.

Principal Investigator (with Shlomo Argamon) on National Science Foundation grant “Community resources for author identification” to Rutgers University, CNS-0454126, 2005, \$56,019 total.

Principal Investigator on Knowledge Discovery and Dissemination (KD-D) grant to DIMACS “Author Identification,” 2004, \$250,000 total.

Co-Principal Investigator on National Science Foundation grant “Monitoring Message Streams” to DIMACS, Rutgers University, KDI-0087022, 2002-2008, \$1,500,000 total (annual renewal).

Investigator on National Science Foundation grant “Computational and Mathematical Epidemiology” to DIMACS, Rutgers University, ITR-0205116, 2002-2007, \$2,750,000 total.

Principal Investigator on National Science Foundation grant “Bayesian Data Analysis for Digital Traces” to Rutgers University, DMS-0113236, 2001-2004, \$245,000 total.

Principal Investigator (with Steen Andersson and Michael Perlman) on National Science Foundation grant “Graphical Markov Models” to the University of Washington, DMS-9704573, 1997-2000, \$313,722 total.

Principal Investigator (with Steven Tanimoto) on grant from National Science Foundation to University of Washington: “Use of Online Assessment in Forming and Coaching Learning Groups,” 1996-1999, \$600,501, CRLT-9616532.

Principal Investigator on National Science Foundation grant “Computing Environments for Graphical Models” to the University of Washington, DMS-92111629, 1992-1996, \$65,000 total.

Principal Investigator on Subcontract to the University of Washington under National Institutes for Health Phase II SBIR grant “TALARIA: Multimedia tools for cancer pain education” to Mathsoft, Inc., 1995-1997, \$750,000 total (UW Subcontract, \$231,652).

Principal Investigator on Subcontract to the University of Washington under National Institutes for Health Phase I SBIR grant “An intelligent tutoring system for biostatistics” to Statistical Sciences, Inc., 1994-5, \$80,853.

Principal Investigator on National Institutes for Health SBIR Phase I grant “A Multimedia Teaching and Reference Tool for Cancer Pain” to Statistical Sciences, Inc., 1993-1994, \$50,000 total.

Investigator (20%) on Quantum Health Resources Grant “Knowledge-based Systems for Bone Marrow Transplant Long Term Follow-up” to the Fred Hutchinson Cancer Research Center, 1993-94, \$1m (C. Richard Chapman, P.I.).

Investigator (and author) on Department of Energy Phase I SBIR grant “An intelligent tutoring system for statistics” to Statistical Sciences, Inc., 1993-4, \$75,000.

Investigator (10%) on Robert Wood Johnson Foundation grant to the Department of Family Medicine, University of Washington (Sharon Dobie, PI), 1995-1999.

Investigator (5%) on American College of Clinical Pharmacy grant to the Department of Family Medicine, University of Washington (Allan Ellsworth, PI), 1995-1996.

Patents

Ju, W., Krishnakumar, A.S., Krishnan, P., and Madigan, D. (2008). Method and apparatus for positioning a set of terminals in an indoor wireless environment. US PTO # 7403784.

Selected Invited Presentations

Penn State Medical School, “Real Real-World Evidence” November 2022.

International Biometrics Conference, Riga, Latvia (presidential keynote), “Real Real-World Evidence” July 2022.

UMass Flex Conference, Amherst, “Flexible Learning at Northeastern,” April 2022.

ECOSTA (virtual), “Real Real-World Evidence” June 2021.

ISPOR 2021 (virtual), “We have the technology,” April 2021.

Temple University, Data Science Meeting (virtual), “Real Real-World Evidence” November 2020.

Joint Statistical Meeting (virtual), “OHDSI Methods for Causal Inference” August 2020.

Advances in Precision Medicine Conference, Columbia University (virtual), “Real Real-World Evidence” April 2020.

EPFL, Switzerland (virtual), “Real Real-World Evidence” April 2020.

University at Buffalo, “Real Real-World Evidence” November 2019.

AMS Regionakl Meeting, Riverside, CA, “Real Real-World Evidence,” November 2019.

ASA NJ Chapter / Bayer 7th Annual Workshop, Keynote Speaker, “Real Real-World Evidence,” November 2019.

National Academy of Science, Applying Big Data to Address the Social Determinants of Health in Oncology, “Real Real-World Evidence,” October 2019.

University of Florida Informatics Institute, Annual Symposium, Keynote, “Real Real-World Evidence,” October 2019.

Harvard University Department of Healthcare Policy, “Real Real-World Evidence” September 2019.

U. Penn Big Data in Healthcare Meeting, Washington, DC, “Real-World Evidence” September 2019.

Duke-Margolis Meeting on Leveraging RCTs to Generate Real-World Evidence, Washington, DC, “Real-World Outcomes” July 2019.

NYC R Conference, New York, “Honest Inference from Observational Studies” May 2019.

Data Science Dean’s Speaker Series, SUNY Binghamton, “Honest Inference from Observational Studies” April 2019.

Neyman Lecture, University of California, Berkeley, “Honest Inference from Observational Studies” March 2019.

Arizona State University, Phoenix, “Honest Inference from Observational Studies” November 2018.

Boston University, Boston, “Ethical Challenges in Drug Development” October 2018.

IQVIA Research Institute Forum, Boston, “Honest Inference from Observational Studies” July 2018.

Keynote Address, FDA Center for Biologics Evaluation Research Science Day, “Honest Inference from Observational Studies” June 2018.

ASA Conference on Statistical Learning and Data Science, Keynote Address, “Honest Inference from Observational Studies” June 2018.

Atlantic Causal Inference Conference, “A Bayesian approach to modeling negative controls in observational studies.” CMU, May 2018.

University of Arizona, “Honest Inference from Observational Studies” April 2018.

Temple University, “Honest Inference from Observational Studies” April 2018.

CRM Montreal, Workshop on Risk Modeling, Management and Mitigation in Health Sciences, “A data-driven world: opportunities and challenges,” December 2017.

Royal Society London, Workshop on the Ubiquity of Algorithms, “A data-driven world: opportunities and challenges,” October 2017.

New York University, Center for Data Science, “A data-driven world: opportunities and challenges,” October 2017.

Pfizer Analytics Summit, “Honest Inference from Observational Studies” October 2017.

American Express, New York, “A data-driven world: opportunities and challenges,” September 2017.

IBM Watson Computational Health Summit, “Honest Inference from Observational Studies” May 2017.

IMS Spring Research Conference, Rutgers, Keynote Address, “Honest Inference from Observational Studies” May 2017.

New England Statistics Symposium, U Conn, Keynote Address, “Honest Inference from Observational Studies” April 2017.

IBM Watson, Yorktown Heights, NY, “Honest Inference from Observational Studies” March 2017.

Sackler Meeting at the National Academy of Sciences, Washington, DC, “Honest Inference from Observational Studies” March 2017.

University of Wisconsin, Department of Biostatistics, “Honest Inference from Observational Studies” November 2016.

Vanderbilt University, Department of Biostatistics, “Honest Inference from Observational Studies” October 2016.

Dana-Farber Reproducibility in Personalized Medicine Research Workshop, Boston, “Honest Inference from Observational Studies,” September 2016.

EXPERT 2016: Trailblazers, “Large-scale Observational Healthcare Data: Promise and Peril,” IUPUI, Indianapolis, September 2016.

International Society for Pharmacoepidemiology and Therapeutic Risk Management, Annual Meeting, Dublin, Ireland, August 2016.

International Chinese Statistical Association Applied Statistics Meeting, Keynote Address, Atlanta, “Honest Inference from Observational Studies” June 2016.

Trends and Innovations in Clinical Trial Statistics, Keynote Address, North Carolina, “Honest Inference from Observational Studies” May 2016.

Penn State University, Department of Statistics, “Honest Inference from Observational Studies” April 2016.

Theory of Big Data Conference, London, “Honest Inference from Observational Studies” January 2016.

University of Michigan, Department of Statistics, “Honest Inference from Observational Studies” October 2015.

ASA Connecticut Chapter, Farmington, CT, “Honest Inference from Observational Studies” April 2015.

Sackler Meeting at the National Academy of Sciences, Washington, DC, “Honest Inference from Observational Studies” March 2015.

NISS Affiliates Workshop, Miami FL, “Observational Studies: Lessons from OMOP and OHDSI” March 2015.

ENAR, Miami FL, “Observational Studies: Lessons from OMOP and OHDSI” March 2015.

U. Mass Medical School Grand Rounds, Worcester, MA, “Observational Studies: Lessons from OMOP and OHDSI” February 2015.

11th Global Cardiovascular Clinical Trials Forum, Washington, DC, “Honest Inference from Observational Studies” December 2014.

Duke University, Department of Statistical Science, “Honest Inference from Observational Studies” October 2014.

Good Medical Research Conference, Cooper Union, New York, “Honest Inference from Observational Studies” October 2014.

First Seattle Symposium on Healthcare Data Analytics, Group Health, Seattle, “Honest Inference from Observational Studies” September 2014.

Institute for Data Sciences and Engineering, Columbia University, “Are Observational Studies Any Good?” September 2014.

Joint Statistical Meetings, Boston, Lunch with the Speaker, “Are Observational Studies Any Good?” August 2014.

Rutgers Annual Statistics Symposium, “Are Observational Studies Any Good?” May 2014.

Keynote Address, SIAM International Conference on Data Mining, Philadelphia, “Are Observational Studies Any Good?” April 2014.

Rustagi Lecture, Ohio State University, “Calibrating Observational Studies” April 2014.

ENAR, Baltimore, “Calibrating Observational Studies” March 2014.

Stern School, New York University, “Are Observational Studies Any Good?” March 2014.

PaSiPhIC Conference, San Luis Obispo, “Are Observational Studies Any Good?” Keynote address, February 2014.

Robert Wood Johnson/Rutgers, “Are Observational Studies Any Good?” December 2013.

Pfizer Inc., New York, “The Bayesian List Machine” October 2013.

University at Buffalo, “Are Observational Studies Any Good?” October 2013.

Joint Statistical Meetings, Montreal, “The Bayesian List Machine,” August 2013.

NYC R-Meetup, “Are Observational Studies Any Good?” July 2013.

IMA New Directions Summer School, University of Minnesota, June 2013.

McGill University, Department of Epidemiology, Biostatistics & Occupational Health, “Are Observational Studies Any Good?” February 2013.

Brown University, Department of Biostatistics, “Are Observational Studies Any Good?” November 2012.

Pfizer Inc., New York, “Are Observational Studies Any Good?” November 2012.

Yale University, Department of Biostatistics, “Are Observational Studies Any Good?” November 2012.

University of Montreal, Canada, “Are Observational Studies Any Good?” October 2012.

Rutgers University, Department of Statistics, “Are Observational Studies Any Good?” October 2012.

Carnegie Mellon University, Department of Statistics, “Are Observational Studies Any Good?” October 2012.

Yale University, Department of Statistics, “Are Observational Studies Any Good?” October 2012.

SAMSI Opening Workshop on Data-Driven Decisions in Healthcare, “A Predictivist Approach to Observational Analyses in Healthcare,” SAMSI, August 2012.

Atlantic Causal Inference Conference, “Big-Data-Driven Medicine,” Baltimore, May 2012.

Interface 2012, “Massive Parallelization of Serial Inference Algorithms for a Complex Generalized Linear Model,” Houston, TX, May 2012.

IMA Meeting on User-Centered Modeling, “Big-Data-Driven Medicine,” Minneapolis, May 2012.

New York City Center for Innovation Through Data Intelligence, “Big-Data-Driven Medicine,” New York City, April 2012.

University of Texas at Austin, “High-Dimensional Pharmacoepidemiology,” Austin TX, April 2012.

ENAR Spring Meeting, “High-Dimensional Pharmacoepidemiology,” Washington DC, April 2012.

Institute of Medicine Meeting on Healthcare Data, “High-Dimensional Pharmacoepidemiology,” Washington DC, March 2012.

Wharton Business School, “Statistical Methods for Drug Safety Surveillance: Big Data to the Rescue?” Philadelphia, December 2011.

New Paradigms in Clinical Trial Methodology Symposium, “Medicine meets Big Data,” Research Triangle Park, NC, November 2011.

Drug Information Association Annual Meeting, “OMOP – A Summary of the Findings,” Chicago, June 2011.

Drug Safety Research Unit 6th Biennial Conference - Signal Detection & Interpretation in Pharmacovigilance, London, “Signal Detection Methods,” June 2011.

New York Machine Learning Meet-up, New York, “Bayesian model averaging – new tricks for an old dog,” May 2011.

Café Science public lecture, New York, “How safe are your prescription drugs?” May 2011.

PhRMA/FDA Statistical Leaders Conference, Washington DC, “Bayesian methods in active surveillance,” April 2011.

AcademyHealth, Electronic Data Methods Forum Symposium, Washington, DC, “OMOP Initial Findings,” April 2011.

North Carolina State University, “Drug Safety”, April 2011

DIA Computational Science Meeting, Washington DC, “Self-controlled methods for analyzing recurrent events in large-scale longitudinal data,” March 2011.

Department of Mathematics and Statistics, Bowling Green State University, “Active Surveillance for Drug Safety,” Bowling Green, OH, December 2010.

Second Annual Princeton Day of Statistics, “Active Surveillance for Drug Safety,” Princeton, NJ, October 2010.

Workshop on Recent Advances in Bayesian Computation, “Big Bayesian Logistic Regression,” Singapore, September 2010.

Joint Statistical Meetings, “The Observational Medical Outcomes Partnership,” Vancouver, Canada, August 2010.

Sparsity Workshop, University of Bristol, “Sparse methods in drug safety,” Bristol, U.K., June 2010.

Valencia 9 International Meeting on Bayesian Statistics, “Bayesian methods in pharmacovigilance,” Benidorm, Spain, June 2010

CRiSM Workshop on Model Uncertainty, “Sequential Bayesian Model Averaging,” Warwick, U.K., May 2010

Data Mining and Nonparametric Statistics conference, “Active Surveillance for Drug Safety,” Columbus, OH, May 2010.

International Society for Pharmacoepidemiology, mid-year meeting, “Observational Medical Outcomes Partnership: Methods Update,” Raleigh, NC, April 2010.

Department of Statistics, Harvard University, “Active Surveillance for Drug Safety,” Cambridge, MA, March 2010.

Frontiers of Statistical Decision Making and Bayesian Analysis (in honor of Jim Berger), “Active Surveillance for Drug Safety,” San Antonio, March, 2010.

American Society for Microbiology Biodefense Meeting, “A cross-species analysis of the CDC anthrax vaccine safety data,” Baltimore, February, 2010.

DIMACS 20th Anniversary Conference, “Drug safety, port security, and anthrax: A DIMACS medley,” New Jersey, November, 2009.

DIA 2nd Annual Conference on Signal Detection and Data Mining, “The OMOP Project,” New York, November 2009.

Keynote Speaker at 11th Annual Johnson & Johnson Statistics Conference, “Post-marketing drug safety surveillance: new developments,” New Jersey, October, 2009.

CDC Annual Anthrax Vaccine Research Meeting, “Correlates of protection, the bridge from animals to humans,” September 2009.

Joint Statistical Meetings, “Sequential Bayesian Model Selection,” Washington, DC, August 2009

IMS Medallion Lecture, WNAR Conference, “High Dimensional Bayesian Classifiers,” Portland, Oregon, June 2009.

Quality and Productivity Research Conference, “High Dimensional Bayesian Classifiers,” IBM Watson, June 2009.

Taft Competitive Lecture, University of Cincinnati, “How safe are your drugs?,” May, 2009

Department of Biomedical Informatics, Columbia University, “Shrinkage methods for drug safety,” New York, March 2009.

Roche Global Safety Science Meeting, “Logistic regression for drug safety,” Vienna, Austria, February 2009.

Department of Statistics, Rice University, “Shrinkage methods for drug safety,” Houston, TX, January 2009.

Department of Statistics, University of Illinois, “Shrinkage methods for drug safety,” Champaign, IL, December 2008.

Drug Information Association Signal Detection and Data Mining workshop, “Shrinkage methods for drug safety,” Washington DC, November 2008.

DIMACS Port Security Workshop, “Efficient sequential decision making algorithms for container inspection operations,” New Jersey, November 2008.

Psychiatry Institute, Columbia University, “Data mining and the drug development process: Safety,” New York, September 2008.

Institute of Mathematical Statistics Annual Meeting, “High Dimensional Bayesian Classifiers,” Singapore, July 2008.

International Conference on Machine Learning and Data Mining, half day tutorial, “Text Mining,” Beijing, China, June 2008.

International Conference on Machine Learning and Data Mining, “Data mining and the drug development process: Safety,” Beijing, China, June 2008.

International Indian Statistical Association Annual Meeting. “Data mining and the drug development process: Safety,” University of Connecticut, May 2008.

10th Annual Symposium on Statistics in Psychiatry, “High-dimensional Bayesian classifiers,” New York University, May 2008.

Brooklyn Law School, “Secrets of Vioxx: Lessons for Drug Safety,” April 2008.

Columbia University, Department of Applied Mathematics, “High-dimensional Bayesian classifiers,” April 2008.

NIH/NIAID, “Secrets of Vioxx: Lessons for Drug Safety,” March 2008.

CDC Anthrax Vaccine Correlate of Protection Meeting, “Predictive modeling building for correlates of protection,” March 2008.

Tenth Annual Winter Workshop, Bayesian Model Selection and Objective Methods, University of Florida, “High-Dimensional Bayesian Classifiers,” January 2008.

University of Pennsylvania Wharton Business School, “Secrets of Vioxx: Lessons for Drug Safety in the Drug Development Process,” December 2007.

University of Washington Department of Biostatistics, “Secrets of Vioxx: Lessons for Drug Safety in the Drug Development Process,” November 2007.

Annual meeting of the International Society of Pharmacovigilance, Bournemouth, UK, “How to Shrink in Pharmacovigilance,” October, 2007.

SIAM Conference on Mathematics for Industry, Philadelphia, PA, “Pharmacovigilance: new methods needed,” October, 2007.

U. Penn Invitational Choice symposium, Philadelphia, PA, “Statistical Analysis: Bigger and Bigger,” June 2007.

Midwest Biopharmaceutical Statistics Workshop, Muncie IN, “Bayesian post-marketing drug safety surveillance,” May 2007.

Yale University, “Lasso Logistic Regression: Recent Developments” April, 2007.

ENAR Annual Meeting, Atlanta GA, “Bayesian post-marketing drug safety surveillance,” March 2007.

Duke University, “Lasso Logistic Regression: Recent Developments” November, 2006.

CDC Anthrax Vaccine Research Program Seventh Annual Investigator’s Meeting, “Non-Human Primate Study,” Atlanta, GA, October 2006.

UCLA Undergraduate Statistics Program, “Localization in Wireless Networks”, two-day practicum, June 2006, Los Angeles.

Classification Society of North America Annual Meeting, “The Power of the Prior,” May 2006, New Jersey.

Workshop on The Science of Learning and the Teaching of Math and Science, “Facet-Based Learning,” May, 2006, Rutgers University.

Data Mining in Pharmacovigilance, April 2006, Pfizer, New York City

Data Mining in Pharmacovigilance, March 2006, DIA Meeting, Washington, DC

University of Chicago, “Sparse Bayesian Classification”, February 2006.

Data Mining in Drug Safety, February 2006, DIMACS Workshop

Bayesian Statistics VIII, June 2006, Valencia, Invited talk. (declined due to conflict)

Drug Information Association Tutorial on Data Mining for Pharmacovigilance, Washington D.C., January 2006.

CDC Anthrax Vaccine Research Program Sixth Annual Investigator's Meeting, "Non-Human Primate Study: Interim Report," Atlanta, GA, October 2005.

NISS Workshop in Honor of Jon Kettenring, Better Data Analysis with Prior Knowledge, September 2005.

SAMSI Workshop on Homeland Security and National Defence, Statistical Methods for Authorship Attribution, SAMSI, September 2005.

Mitre Workshop on the Significance of Bioinformatics to National Security, Washington D.C., June 2005

Plenary Address, Graybill Conference, "Text Mining," Colorado, June 2005.

Google, New York, "Text mining," April 2005

Princeton University, "Online logistic regression," March 2005

American Statistical Association, Florida Chapter, Annual Meeting, "From Sewage to Guns: 20 Years of Statistical Consulting", February 2005.

Florida State University, "The statistical analysis of text data", February 2005

MCMSki Workshop, Bormio, Italy, "Text categorization", January 2005.

M2004 SAS Data Mining Conference, "Text mining", October, 2004

Pacific Northwest National Laboratory, "Bayesian Model Selection", October, 2004

Bell Labs, "Bayesian Location Estimation", October, 2004

JSM, Toronto, "Bayesian Location Estimation", August, 2004

Bertinoro, Italy, Workshop on the Mathematics of Web Search, "Statistical Analysis of text Data", June 2004.

Wharton Business School, "Bayesian text categorization," April 2004.

DIMACS Workshop on Data Mining and Epidemiology, "Data Mining: An Overview", March 2004.

Columbia University, "Statistical methods for the analysis of textual data", September 2003.

University of Aalborg, Denmark, "Bayesian graphical models for location determination", September 2003

SAMSI, "Statistical methods for the analysis of textual data", September 2003.

ISI, Berlin, "Text Categorization", August 2003.

DIMACS Working Group on Data Mining and Epidemiology, "Analysis of Hospital Discharge Data", May 2003.

Johns Hopkins University, "Text categorization", May 2003

North Carolina State University, "Text Categorization", May 2003

Cleveland Clinic, "Graphical Markov Models", December, 2002.

IBM TJ Watson, "Text Categorization", November, 2002

Educational Testing Service, "Sequential Monte Carlo Methods for Massive Datasets", November, 2002

University of Connecticut, "Text Categorization", September, 2002

IMS Annual Meeting, Banff, Canada, "Retrieval properties of large collections," July, 2002.

IMS Annual Meeting, Banff, Canada, "Bayesian analysis of hidden Markov models," July, 2002.

Keynote Speaker, 22nd International Symposium on Forecasting, Dublin, "Bayesian analysis of hidden Markov models", June 2002.

Bayesian Statistics VII, June 2002, Valencia, Invited discussion.

Duke University, "Text Categorization", May 2002.

University of California, Irvine, "Text Categorization", April 2002.

University of Southern California, "Text Categorization", April 2002.

New York University, "Bayesian analysis of hidden Markov models", April 2002.

DIMACS Epidemiology Workshop, "Some aspects of adverse events detection." March 2002.

Temple University, "Text Categorization", April 2002.

Haifa Winter Workshop on Computer Science and Statistics, Technion, Haifa, Israel, "Bayesian Analysis of Hidden Markov Models." December, 2001.

Haifa Winter Workshop on Computer Science and Statistics, University of Haifa, Israel, "Likelihood-based Data Squashing." December, 2001.

Columbia University, Graphical Models and Bayesian Networks: A History. October, 2001.

SCILS, Rutgers University, Bayesian statistical methods for digital traces, April, 2001.

Bell Labs, Data warehousing and reporting: a case study, January, 2001.

Rutgers University, Graphical Markov Models, December, 2000.

University of Washington. Data squashing. November 2000.

Royal Statistical Society Annual Meeting, University of Reading. Graphical Models and Bayesian Networks: A History. September, 2000.

University of Chicago Business School. Data squashing. November 1999.

Joint Statistical Meetings, August 1999, Baltimore. "Bayesian data mining in large frequency tables."

UW Mathday Plenary Speaker. Data in-Garbage out: How to twist the truth with statistics. March 1999.

Bell Labs, Bayesian Model Selection. January 1999.

Seventh International Workshop on AI and Statistics, Florida. Bayesian Graphical Models, Intention-to-Treat, and the Rubin Causal Model. January, 1999.

Bayesian Statistics VI, June 1998, Valencia, Invited discussion.

Bellcore, "Bayesian Collaborative Filtering" June 1998.

Cambridge University, Statistical Laboratory, "Noncompliance in clinical trials," October 1997.

Isaac Newton Institute for Mathematical Sciences, Cambridge, UK "Bayesian model averaging," October 1997.

Trinity College Dublin, "Bayesian model averaging," October 1997.

UW/Microsoft Data Mining Institute, "Bayesian model averaging," July 1997.

KDD-97, "Graphical models," August 1997.

"The World-Wide Web as a Statistical Producer," Derry, Northern Ireland, "Statistical Analysis of Web-Generated Data," April 1997.

International Association for Statistical Computing, Pasadena, CA, "Graphical Markov Models for Chain Graphs," February 1997.

Sixth International Workshop on AI and Statistics, Florida, "Bayesian Information Retrieval," January, 1997.

Royal Statistical Society, Special Session sponsored by the Research Section, Invited Talk, "Dealing with model uncertainty," September, 1996.

ETS, Princeton, New Jersey, August 1996, "Bayesian model averaging."

Joint Statistical Meetings, August 1996, Chicago. "Bayesian information retrieval."

First European Conference on Highly Structured Stochastic Systems, Rebild, Denmark, May 1996.

INFORMS (formerly ORSA-TIMS) meeting, May 1996, Washington DC, "New developments in Bayesian model averaging."

Departments of Philosophy and Statistics, Carnegie-Mellon University, Invited talks, May 1996.

ENAR meetings, Richmond, VA, and ISDS, Duke University, "Model Selection and Averaging with Biostatistics applications," March 1996, invited.

Department of Mathematical Sciences, University of Alaska at Fairbanks, February 1996, invited.

NIPS Conference, Vail, Colorado December 1995, "Bayesian model averaging and model selection for Markov equivalence classes of acyclic digraphs"

Model Uncertainty Workshop, Bath, England, June 1995, "New developments in Bayesian model averaging."

Algebraic Methods in Multivariate Statistics, Oberwolfach, Germany, July 1995.

Workshop on Maximum Entropy and Bayesian Methods, Sante Fe, July 1995, "New developments in Bayesian model averaging."

Department of Psychology, UW, Facet-based Learning for Statistics, April, 1995

Fifth International Workshop on Artificial Intelligence and Statistics, Florida, Plenary Talk, "Test selection for graphical models," January 1995.

Department of Statistics, UW, Facet-based Learning for Statistics, December, 1994

European Conference on Hypermedia Technology, Edinburgh, Scotland, September 1994, "Repertory hypergrids: An application to clinical practice guidelines."

Bell Communications Research, August 1994, "Repertory hypergrids for hypermedia."

Bell Laboratories, August 1994, "Model Uncertainty" .

IMS Meeting, June 1994, Chapel Hill, "Computations for Bayesian graphical models."

Bayesian Statistics V, June 1994, Valencia, "Improving the predictive performance of Bayesian graphical models."

The Seventh Annual Florida Artificial Intelligence Research Symposium, May 1994. “Building Bayesian models for intelligent tutoring systems.”

Joint Statistical Meetings, August 1993, San Francisco. “Accounting for Model Uncertainty.”

First ACM Workshop on Multimedia in Medical Education, August 1993, Anaheim. “Multimedia tools for Cancer Pain Education.”

Bayes Factors and Sensitivity Analysis Workshop, February 1993, UCLA. “Bayesian graphical models.”

Society for Medical Decision Making, October 1992, Portland, Oregon. “Bayesian Statistics.”

Joint Statistical Meetings, August, 1992, Boston. “Model Selection and Accounting for Model Uncertainty in Graphical Models using Occam’s Window.”

The Second International Conference on Music Perception and Cognition, February, 1992, Los Angeles. “Development of a Data-based Expectancy Model.”

Scholarly Service Activities

Scholarly Journals

Associate Editor, *International Statistical Review*, 2022-.

Associate Editor, *Harvard Data Science Review*, 2018-.

Editorial Board, *Journal of Scientific Practice and Integrity*, 2018-2023.

Member, Editorial Committee, *Annual Reviews of Statistics and its Application*, 2018-2021.

Editor-in-Chief, *Statistical Analysis and Data Mining – the ASA Data Science Journal*, 2013-2015.

Associate Editor, *Statistical Science*, 2011-2013.

Editor-in-Chief, *Statistical Science*, 2008-2010.

Editorial Board, *Therapeutic Innovation and Regulatory Science*, 2013-

Editorial Board, *International Journal of Occupational and Environmental Health*, 2012-2017

Advisory Board, Wiley Interscience Review Series (WIRES) On Data Mining And Knowledge Discovery, 2008-

Editorial Board, *Foundations and Trends in Machine Learning*, 2007-2021.

Senior Associate Editor, *Advances in Disease Surveillance*, 2005-2009.

Advisory Board, *Bayesian Analysis*, 2004-2006.

Action Editor, *Journal of Machine Learning Research*, 2003-2006.

Associate Editor, *Journal of Computational and Graphical Statistics*, 1997-2002.

Associate Editor, *Journal of the Royal Statistical Society (Series B)*, 1995-1999.

Editor of special issue of the *International Journal of Human-Computer Studies*: “Knowledge-based hypermedia,” 1995.

Editorial Board for the *Handbook of Knowledge Discovery and Data Mining*, 1997-2000.

Editorial Board for the *Journal of Data Mining and Knowledge Discovery*, 1996-2004.

Professional Societies

Co-Chair, ACM-IMS Data Science Joint Venture, 2019-2021.

Chair, ASA Breiman Award Committee, 2019-2020.

Member, International Society for Pharmacoeconomics and Outcomes Research (ISPOR) Task Force in Enhancing the Utility of Real World Evidence for Decision Making, 2016-2017.

Charter Member, International Prize in Statistics Foundation, 2014-2017.

Publications Officer, Statistical Learning and Data Mining Section, American Statistical Association, 2014-2016.

Chair, Ad-Hoc IMS Committee to select the editor-in-chief of the *Statistical Science*, 2012.

IMS representative to the steering committee for the International Year of Statistics, 2013.

Program Chair, Statistical Learning and Data Mining Section, American Statistical Association, 2009-2010.

Chair, ISBA Constitution and Bylaws Committee, 2009-2014

Program Chair, Institute of Mathematical Statistics, 2005.

Member, Ad-Hoc IMS Committee to select the editor of the *Annals of Applied Statistics*, 2006.

Member, Ad-Hoc ISBA Committee to select the editor of *Bayesian Analysis*, 2006.

Elected Member of the ISBA Board (International Society Bayesian Analysis), 2005-2006.

Program Chair, Statistical Computing Section, American Statistical Association, 2003-2004.

Conferences

Program Chair, ACM-IMS Conference on the Foundations of Data Science (FODS-2020).

Co-Chair, Pfizer-ASA-Columbia Symposium on Risks and Opportunities of AI in Pharmaceutical Science, June 6, 2022, June 5, 2023.

Co-Chair, ACM-IMS Interdisciplinary Summit on the Foundations of Data Science, June 15, 2019, San Francisco.

Member, NAS Leveraging Randomized Designs to Generate Real World Evidence for Regulatory Purposes Planning Committee, 2019.

Member, NAS Real World Evidence Workshop Planning Committee, 2017.

Co-Organizer, Workshop on Transdisciplinary Foundations of Data Science, Institute of Mathematics and its Applications, Minnesota, September 2016.

Chair, Organizing Committee for International Year of Statistics Capstone Workshop, 2012-13.

Member, Senior Program Committee, KDD-2011.

Member, Program Committee, 2nd International Conference on Algorithmic Decision Theory, DIMACS, 2011

Co-Chair, BioSurveillance 2007: NSF BioSurveillance Workshop: Systems and Case Studies.

Student Awards Chair, KDD-2004, *The ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*.

Member of the Organizing Committee for the National Syndromic Surveillance Conference, 2003, 2004.

Member of the KDD-2003, *The ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, Best Paper Award Committee, 2003.

Program Chair, KDD-1999, *The ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*.

Program Chair, AISTATS-07, *Sixth International Workshop on Artificial Intelligence and Statistics*, 1997.

Member of the program committee for Association for Computing Machinery Special Interest Group on Information Retrieval Annual Conference (ACM SIGIR)-2002, 03, 04.

Member of the program committee for KDD-95, 96, 97, 98, 99, 00, 01, 02, & 2004 Knowledge Discovery in Databases.

Member of the program committee for UAI-95, 96, 97, 98, 99, 02, 03 & 04, the Annual Conference on Uncertainty in Artificial Intelligence.

Member of the program committee for AISTATS-95, 97, 99, 01, 03 & 05, the International Workshop on Artificial Intelligence and Statistics.

Member of the program committee for IDA-01, Intelligent Data Analysis.

Co-organizer, Workshop on Learning in Graphical Models, NIPS, Colorado, December, 1995.

Co-Chair for Institute of Mathematical Statistics/National Science Foundation Graphical Models Summer Workshop, 1997.

Member of the program committee for Florida Artificial Intelligence Research Symposium (FLAIRS) 1996 & 1997 Uncertain Reasoning in Artificial Intelligence Track, Florida.

Government

Chair, Scientific Advisory Committee, Insight Data Science Ireland, 2020-

Member, Organizing Committee NSF Statistics at a Crossroads, 2018.

Member, NAS Committee on Applied and Theoretical Statistics, 2017-2020.

Consultant, FDA Advisory Committees, 2014-2017.

Member, FDA Advisory Committee on Drug Safety and Risk Management, 2011-2014.

NIH Panel member, Special Emphasis Panel/Scientific Review Group 2012/10 ZRG1 PSE-B (02) M, 2012.

Member, NAS-NRC Committee on Massive Data, 2010-2011.

Member, FDA Science Board – CDER sub-committee, 2010-2011.

Science Foundation Ireland Mathematics Review Panel, March, 2005, October 2005, February 2006, November 2006, March 2007.

National Science Foundation Artificial Intelligence and Cognitive Science Review Panel, 2004

National Science Foundation Statistics Review Panel, 2003, 2004, 2007

Member of the Institute of Medicine Committee to Review the CDC Anthrax Vaccine Safety and Efficacy Research Program, 2000-2002.

Other

Member, Research Committee, National Association of Sports Officials, 2019-

Member, International and Independent External Advisory Board of the Early Detection of Neurodegenerative Diseases (EDoN) initiative, 2019-2023

Member, Scientific Advisory Committee, Insight Centre for Data Analytics, 2019-

External Review Committee for the School of Computer Science and Statistics, Trinity College Dublin, February 2016.

External Review Committee for the Harvard Division of Continuing Education, February 2016.

External Review Committee for Statistics (Chair), Cornell, April 2015.

External Review Committee for Arts & Sciences (Chair), Emory University, April 2015.

External Review Committee for Statistics (Chair), Carnegie Mellon University, 2013.

Member, DIMACS Advisory Board, 2013-

Member, CCICADA Advisory Board, 2012-

Member, Advisory Board, University of Maryland “Development and Evaluation of Search Technology for Discovery of Evidence in Civil Litigation.” 2011-2014.

Co-Organizer of Summer 2011 Undergraduate “Explorations in Statistics” camp, 30 students.

Member, Advisory Board, Command, Control, and Interoperability Center for Advanced Data Analysis, A Department of Homeland Security Center of Excellence, 2010-

External Review Committee for Biostatistics, Columbia University, May 2012.

External Review Committee for Statistics, Harvard University, April 2010.

External Review Committee for Statistics (Chair), Duke University, 2009.

External Review Committee for Statistics, University of North Carolina, 2008.

Editorial Board, ASA-SIAM Series on Statistics and Applied Probability, 2006-2008.

Series Editor, Chapman and Hall Computer Science and Data Analysis Series, 2002-2021.

External Examiner for PhD Dissertation of Susanne Bottcher, Aalborg University, Denmark, June 2004.

External Examiner for PhD Dissertation of Bo Thieson, Aalborg University, Denmark, September 1996.

Selected Consulting Activities

Consultant, Aris Global, 2012.

Consultant, Emergent Biosolutions, 2012-2013.

Consultant, Pharmaceutical Development Group, Inc., 2012-2020.

Consultant, DaVita Inc., 2010.

Consultant, Boehringer Ingelheim, 2010.
 Consultant, Foundation for the NIH, OMOP, 2009-2013.
 Consultant, CDC Anthrax Vaccine Research program, 2005-2010.
 Consultant, Skarven Enterprises/Boeing, 2003-2012.
 Consultant, Wyeth Pharmaceutical, 2006, 2008-09.
 Consultant, Novartis Inc., 2006-2008.
 Consultant, Takeda Inc., 2008, 2011, 2021-2023 (EMBOLDEN DSMB).
 Consultant, Pfizer Inc., 2007-2008, 2013-14.
 Advisory Board, mediGuard/Quintiles, 2007-2011.
 Consultant, Adready Inc., 2008.
 Consultant, Jarvik Heart Inc., 2009-2016,
 Consultant, GSK Inc., 2009.
 Consultant, Eli Lilly Inc., 2016-2018.
 Consultant, Endo Pharmaceuticals Inc., 2016-2017.
 Consultant, Merck, 2016.
 Consultant, Heron Therapeutics Inc., 2018-2019.
 Consultant, Shire Plc, 2018-2020.
 Consultant, Bayer Inc., 2019-.
 Consultant, Quest Partners, 2019-2020.
 Consultant in litigation in the last four years related to 3M, Abilify, Incretins, Lyft, Navient, Roundup, Talc, Taxotere, Valsartan, and Zostavax.

PhD Committee Chairmanships

1. Jeremy C. York, Dissertation Title: “Bayesian Methods for the Analysis of Misclassified or Incomplete Multivariate Discrete Data.” PhD Awarded 1992. Winner of the Savage Outstanding Dissertation Award. Currently employed at amazon.com, Seattle.
2. Jennifer Hoeting, Dissertation Title: “Accounting for Model Uncertainty in Linear Regression.” PhD Awarded 1994 (joint with Adrian Raftery). Currently Professor at Colorado State University.
3. Chris Volinsky, Dissertation Title: “Bayesian Model Averaging in Censored Survival Models.” PhD Awarded 1997 (joint with Adrian Raftery). Currently Professor at NYU.
4. Andrew Schaffner, Dissertation Title: “Tools for the Advancement of Undergraduate Statistics Education.” PhD Awarded 1997. Currently Professor at California Polytechnic State University, San Luis Obispo.
5. Michelle Keim, Dissertation Title: “Bayesian Information Retrieval.” PhD Awarded 1997. Currently employed at Detectent, San Diego.
6. Cibeles daSilva, Capture-recapture methodology for bowhead whales. PhD Awarded 1999.
7. Greg Ridgeway, Learning Massive Bayesian Networks. PhD Awarded 1999. Currently Associate Professor, U. Penn.

8. Susana Eyheramendy, Text categorization. PhD Awarded 2003. Currently Professor, Department of Statistics, Pontificia Universidad Catolica de Chile.
9. Ivan Zorych, Location estimation in wireless networks, PhD Awarded 2005 (NJIT/Rutgers). Previously Research Scientist at Columbia University.
10. Aimin Feng, Bayesian methods for post-marketing drug safety surveillance, PhD Awarded 2006. Currently employed at Moderna, Inc.
11. Denise Chang, Individualized hospital report cards, PhD Awarded 2006. Currently employed at Sanofi-Aventis.
12. Suhrid Balakrishnan, Algorithms and Applications for Classifiers of Massive and Structured Data Problems, PhD Awarded 2007. Currently employed at Lionshare
13. Jerry Cheng, Bayesian Methods for Non-Standard Missing Data Problems, PhD Awarded 2010. Currently Assistant Professor at NYIT.
14. Shouhou Zhou, Bayesian Predictive Model Selection Criteria, PhD Awarded 2010. Assistant Professor, Penn State.
15. Shawn Simpson, Self-controlled methods for postmarketing drug safety surveillance in large-scale longitudinal data, PhD Awarded 2011. Currently data scientist at BlackRock Inc.
16. Zach Shahn, Methods for Personalized and Evidence Based Medicine, PhD Awarded 2015. Currently Professor at CUNY.
17. Ed Cheng, Applications of Bayesian Methods of Legal Problems, PhD Awarded 2018. Professor at Vanderbilt
18. Feihan Liu, PhD Awarded 2018. Data Scientist at Upstart Inc.

PhD Committee Memberships

UW PhD Reading Committees

Mayumi Adachi, Department of Music
 Denise Draper, Department of Computer Science
 Geof Givens, Department of Statistics
 Steven Lewis, Department of Statistics
 Heike Blossey, Department of Statistics
 Jeremy York, Department of Statistics (Chair)
 Jennifer Hoeting, Department of Statistics (Chair)
 David Bradshaw, Department of Music
 Craig Donovan, SIPhD
 Dan Hershman, Department of Music
 Tapas Kanungo, Department of Electrical Engineering

UW PhD Committees

Carlos Diaz Avalos, Department of Statistics
 Lang Wu, Department of Statistics
 Renato Assuncao, Department of Statistics
 Dave Higdon, Department of Statistics
 Brian Hopkins, Department of Mathematics

Shili Lin, Department of Statistics
 Brian Lockyear, Department of Computer Science
 Badr al Badr, Department of Electrical Engineering
 Tapas Kanungo, Department of Electrical Engineering
 Michael Heeley, Business School
 Kyung-Im Sung, Department of Electrical Engineering

Rutgers PhD Committees

William McLoughlin, Department of Chemistry
 Francis Mendez, Business School, RU Newark
 Qi Xia, Department of Statistics
 Pai-Hsi Huang, Department of Computer Science
 Yihua Wu, Department of Computer Science
 Aynur Dayanik, Department of Computer Science
 Dmitriy Fradkin, Department of Computer Science
 Ying Sun, School of Communication, Information and Library Studies
 Jun Li, Department of Statistics
 Yong Wang, Department of Genetics

Rutgers MS Committees

Saumitr Pathak, Department of Electrical and Computer Engineering

Columbia PhD Committees

Lucy Robinson, Department of Statistics
 Jane Paik, Department of Statistics
 Mladen Laudanovic, Department of Statistics
 Ragna Haraldsdottir, Department of Statistics
 Tyler McCormick, Department of Statistics
 Kamiar Rahnema Rad, Department of Statistics
 Pannaga Shivaswamy, Department of Computer Science
 Xiaoyan Wang, Department of Biomedical Informatics
 Anil Raj, Department of Applied Physics and Applied Mathematics
 Ivor Cribben, Department of Statistics
 Ying Liu, Department of Statistics
 Maria de los Angeles Resa Juarez, Department of Statistics
 Susanna Makela, Department of Statistics
 David Hirschberg, Department of Statistics
 Yixin Wang, Department of Statistics

Teaching

edX

Statistical Thinking for Data Science and Analytics (joint with 5 other instructors)

Columbia University

Research Design (APANKS5300), Fall 2017
 Bayesian Data Analysis (ERM5580), Spring 2017
 Applied Statistical Methods (W2025), Spring 2012, Spring 2013
 Introduction to Statistical Methods (W3005), Fall 2012, Fall 2014, Fall 2015
 Statistical Consulting, Fall 2008, Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011
 Data Mining, Fall 2008
 Applied Statistics (G6101-2): Fall 2007 - Spring 2008.
 Introduction to Statistical Reasoning (W1001): Spring 2010, Fall 2010.

Rutgers University

Bayesian Data Analysis: Fall 2002, Spring 2003, Spring 2004, Spring 2006
 Data Mining: Spring 2001, Spring 2002, Fall 2003, Fall 2004.
 Computing and Graphics in Applied Statistics (486): Fall 2001.
 Mathematical Statistics (583): Spring 2003.
 Mathematical Statistics (384): Spring 2007.

University of Washington

Introductory Statistics (311): Spring 1992, Fall 1992, Winter 1994, Spring 1995, Fall 1995, Spring 1997
 Mathematical Statistics (341): Fall 1991, Winter 1991
 Mathematical Statistics (342): Spring 1991
 Introductory Statistics for Social Scientists (361-2): Fall-Winter 1998-9
 Statistics for Engineers (390): Fall 1990, Spring 1993, Fall 1994, Winter 1995, Spring 1996
 Stochastic Processes (396): Spring 1992
 Mathematical Statistics (481): Fall 1993
 Scientific Computing (535): Winter 1996, Winter 1997
 Graphical Models (592): Fall 1991, Winter 1994, Spring 1995 (overload)
 Statistical Consulting (598): Winter 1991, Fall 1992, Spring 1993

University Service**Columbia Service Activities**

Member, Columbia University Institutional Conflict of Interest Committee , 2019-
 Board Member, Columbia University Press, 2013-2016
 Chair, Provost's Faculty Committee on Online Learning, 2012-2018
 Chair, Columbia Shared Research Computing Policy Advisory Committee, 2011-2014
 Executive Committee, Columbia Institute for Data Sciences and Engineering, 2012-
 Member, Search Committee for Biostatistics Chair, 2012.
 Member, Advisory Committee, Institute for Statistics and the Brain, 2012-
 Member, Review Committee for Biostatistics Department, 2011.
 Executive Committee, School of Continuing Education, 2011-2014.
 Chair, Arts and Science Committee on Classroom Technology, 2011-2.
 Member, Task Force on Benefits, 2010-2011.
 Member, Provost's Committee on Retirement, 2011-2.
 Member, Arts and Sciences Space Committee, 2009-2013.

Chair, Search Committee for Dean of the School of Continuing Education, 2008.
Ad-hoc promotion committees (2)

Rutgers Service Activities

Lecturer in workshop for high school teachers on Mathematics in Homeland Security, DIMACS, 2007.
Member of the Faculty of Arts and Sciences Transition Team, 2006.
Member of the Faculty of Arts and Sciences Budget Reduction Committee, 2005-06.
Member of the Faculty of Arts and Sciences Appointments and Promotions Committee, 2003-04.
Member of Organizing Committee for DIMACS Special Focus on Data Mining, 2001-.
Member of Organizing Committee for DIMACS Special Focus on Epidemiology, 2002-.
Co-Organizer of the DIMACS Working Group on Adverse Event and Disease Reporting, Surveillance, and Analysis.
Chair, DIMACS Associate Director Search Committee, 2005-06.
Member, Rutgers University Computer Coordinating Council, 2005-

UW Service Activities

Chair of the Department Computing Committee, 1994-1999.
MS Applied Exam Committee, 1991-1999 (chair in 1993)
PhD Applied Exam Committee, 1993 (reader in other years)
Graduate Program Director, 1998-1999
UW Advisory Board on Accountability, 1998-1999
Seminar Series on Graphical Models, 1990-1991 (with Russell Almond)
Multivariate Analysis and Graphical Models of Association (MAGMA) Seminar Series, 1993-1994, 1996 (with Michael Perlman)
Seminar Co-ordinator, 1991-1992 (including PNWSM)
Director of Consulting, 1993-1994
Mathday Lecture, 1994, 1995, 1997, & 1998
College of Arts and Sciences Distance Learning/Instructional Technology Task Force, 1996
College of Arts and Sciences Graduation Committee, 1996-1998.
UW Distinguished Teaching Award Committee, 1996 and 1997.
Chair, Review Committee for UW Math Science Computing, 1996.

EXHIBIT 2

I, David Madigan, Ph.D., relied on the following materials as discussed in my declaration.

1. Roy et al., “Lead release to potable water during the Flint, Michigan water crisis as revealed by routine biosolids monitoring data”, *Water Research*, Vol. 160, Sept. 1, 2019, 475-483. doi.org/10.1016/j.watres.2019.05.091.
2. Appendix A. Supplementary Data associated with Roy et al. 2019. Word document available at <https://www.sciencedirect.com/science/article/pii/S0043135419304865#appsec1>.
3. Roy and Edwards, “Efficacy of corrosion control and pipe replacement in reducing citywide lead exposure during the Flint, MI water system recovery”, *Environ. Sci.: Water Res. Technol.*, 2020,6, 3024-3031. doi.org/10.1039/D0EW00583E.
4. Supplementary Information associated with Roy and Edwards 2020. PDF available at <https://www.rsc.org/suppdata/d0/ew/d0ew00583e/d0ew00583e1.pdf>
5. Pieper et al. “Evaluating Water Lead Levels During the Flint Water Crisis.” *Environ Sci Technol.* 2018; 52(15):8124-8132. doi:10.1021/acs.est.8b00791.
6. Bates no. VATECH_00139353.
7. Comment and dataset of August 2015 sampling completed by Virginia Tech available at <https://flintwaterstudy.org/2015/12/complete-dataset-lead-results-in-tap-water-for-271-flint-samples/>.
8. Dataset of all Virginia Tech sampling available at <https://flintwaterstudy.org/2017/09/complete-dataset-lead-results-from-tap-water-sampling-in-flint-mi-rounds-1-5/>.

EXHIBIT 3

EXHIBIT 3. R Code

```

foo<-read.table("/Users/madigan/Google Drive/My Drive/Flint/data.txt",header=T,sep="\t")

# Figure 2 R2=0.861; p=0.023
M0 <- lm(BiosolidLeadKg ~ Combo_Lagged, na.action = na.omit, data = foo)
summary(M0)
plot(M0)
acf(residuals(M0))

# no lag R2=0.027; p=0.79
M1 <- lm(BiosolidLeadKg ~ Combo, na.action = na.omit, data = foo)
summary(M1)
plot(M1)
acf(residuals(M1))
yrange = c(min(foo[!is.na(foo$Combo),]$BiosolidLeadKg),max(foo[!is.na(foo$Combo),]$BiosolidLeadKg))
plot(BiosolidLeadKg ~ Combo, data = foo, xlab=expression(paste("Lead in Water (" ,mu,"g/L)")), ylab="Lead in
  Biosolids (Kg)", main="Remove Lag",ylim=yrange)
abline(M1)

# Conc instead of Kg R2=0.563; p=0.14
M2 <- lm(BiosolidLeadConc ~ Combo_Lagged, na.action = na.omit, data = foo)
summary(M2)
plot(M2)
acf(residuals(M2))
yrange =
  c(min(foo[!is.na(foo$Combo_Lagged),]$BiosolidLeadConc),max(foo[!is.na(foo$Combo_Lagged),]$BiosolidLeadConc))
plot(BiosolidLeadConc ~ Combo_Lagged, data = foo, xlab=expression(paste("Lead in Water (" ,mu,"g/L)")),
  ylab=expression(paste("Lead in Biosolids (" ,mu,"g/L)")), main="Concentration instead of Mass",ylim=yrange)
abline(M2)

# FD, 1 or 3 instead of Ave
M3 <- lm(BiosolidLeadKg ~ Pieper_FD_Lagged, na.action = na.omit, data = foo)
summary(M3) # R2=0.862; p=0.02

M4 <- lm(BiosolidLeadKg ~ Pieper_1_Lagged, na.action = na.omit, data = foo)
summary(M4) # R2=0.860; p=0.02

M5 <- lm(BiosolidLeadKg ~ Pieper_3_Lagged, na.action = na.omit, data = foo)
summary(M5) # R2=0.587; p=0.13

# Conc instead of Kg AND no lag
M6 <- lm(BiosolidLeadConc ~ Combo, na.action = na.omit, data = foo)
summary(M6)
plot(M6)
acf(residuals(M6))
yrange = c(min(foo[!is.na(foo$Combo),]$BiosolidLeadConc),max(foo[!is.na(foo$Combo),]$BiosolidLeadConc))

```

```
plot(BiosolidLeadConc ~ Combo, data = foo, xlab=expression(paste("Lead in Water (" ,mu,"g/L)")),
     ylab=expression(paste("Lead in Biosolids (" ,mu,"g/L)")), main="Concentration instead of Mass, Remove
     Lag",ylim=yrange)
abline(M6)
```

```
par(mfrow=c(1,2))
M7 <- lm(BiosolidLeadKg ~ Combo_Lagged_2, na.action = na.omit, data = foo)
summary(M7)
plot(M7)
acf(residuals(M7))
yrange =
  c(min(foo[!is.na(foo$Combo_Lagged_2),]$BiosolidLeadKg),max(foo[!is.na(foo$Combo_Lagged_2),]$BiosolidLeadKg))
plot(BiosolidLeadKg ~ Combo_Lagged_2, data = foo, xlab=expression(paste("Lead in Water (" ,mu,"g/L)")),
     ylab="Lead in Biosolids (Kg)", main="Mass + Two-month Lag",ylim=yrange)
abline(M7)
M8 <- lm(BiosolidLeadConc ~ Combo_Lagged_2, na.action = na.omit, data = foo)
summary(M8)
plot(M8)
acf(residuals(M8))
yrange =
  c(min(foo[!is.na(foo$Combo_Lagged_2),]$BiosolidLeadConc),max(foo[!is.na(foo$Combo_Lagged_2),]$BiosolidLeadConc))
plot(BiosolidLeadConc ~ Combo_Lagged_2, data = foo, xlab=expression(paste("Lead in Water (" ,mu,"g/L)")),
     ylab=expression(paste("Lead in Biosolids (" ,mu,"g/L)")), main="Concentration + Two-month Lag",ylim=yrange)
abline(M8)
```

```
faa <- foo[!is.na(foo$Combo),]
faa$Date <- as.Date(faa$Date, format='%m/%d/%Y')
```

```
par(mfrow=c(1,2))
```

```
plot(BiosolidLeadKg ~ Date, data = faa, type="b",col="blue",xlim=c(as.Date("2015-08-01"),as.Date("2017-08-31")),ylab="")
atBlue <- axTicks(2)
axis(2, labels = FALSE, col = "Blue")
mtext(side = 2, text = atBlue, at = atBlue, col = "Blue", line = 1)
par(new=TRUE)
plot(Combo ~ Date, data = faa, type="b",col="red", yaxt="n",ylab="",xlim=c(as.Date("2015-08-01"),as.Date("2017-08-31")),main="Mass")
atRed <- axTicks(2)
axis(4, labels = FALSE, col = "Red")
mtext(side = 4, text = atRed, at = atRed, col = "Red", line = 1)
legend(as.Date("2016-01-15"),15,c("Biosolid Kg","WLL"),lty=c(1,1),col=c("blue","red"))
```

```
plot(BiosolidLeadConc ~ Date, data = faa, type="b",col="blue",xlim=c(as.Date("2015-08-01"),as.Date("2017-08-31")),ylab="")
atBlue <- axTicks(2)
axis(2, labels = FALSE, col = "Blue")
mtext(side = 2, text = atBlue, at = atBlue, col = "Blue", line = 1)
par(new=TRUE)
```

```
plot(Combo ~ Date, data = faa, type="b",col="red",yaxt="n",ylab="",xlim=c(as.Date("2015-08-01"),as.Date("2017-08-31")),main="Concentration")
atRed <- axTicks(2)
axis(4, labels = FALSE, col = "Red")
mtext(side = 4, text = atRed, at = atRed, col = "Red", line = 1)
legend(as.Date("2016-01-15"),15,c("Biosolid Conc.", "WLL"),lty=c(1,1),col=c("blue", "red"))
```